ACCORDO DI COLLABORAZIONE

Relativo alla partnership per l'implementazione congiunta del progetto di ricerca intitolato

Una prima valutazione della biodiversità del Ghiacciaio dell'Adamello"

TRA

Comunità Montana di Valle Camonica, Piazza Tassara, 3, Breno (BS), Italia, rappresentata da Alessandro Bonomelli in qualità di Presidente, di seguito denominata "Comunità Montana"

E

Università degli Studi di Milano, Dipartimento di Scienze e Politiche Ambientali, Via Festa del Perdono 7, 20122 Milano, Italia, Rappresentata dal Prof. Elio Franzini, in qualità di Rettore dell'Università degli Studi di Milano, di seguito denominata "Partner Capofila"

Università degli Studi di Milano Bicocca, Dipartimento di Scienze della Terra e dell'Ambiente, Piazza dell'Ateneo Nuovo, 1 - 20126 Milano, rappresentata dal Prof. Andrea Zanchi, Direttore del Dipartimento (Partner 1)

Università degli Studi di Siena, Dipartimento di Scienze della Vita, via Banchi di Sotto 55, 53100 Siena, Italia, rappresentata dal Prof. Luca Bini (Partner 2), in qualità di Direttore del Dipartimento di Scienze della Vita

Università Adam Mickiewicz di Poznań, Dipartimento di Tassonomia e Ecologia degli Animali, ul. Wieniawskiego 1 - 61-712 Poznań, Polonia, rappresentata dal Prorettore Prof. Przemysław Wojtaszek (Partner 3)

Singolarmente denominati "Parte" e collettivamente denominati "Parti"

COOPERATION AGREEMENT

Regarding a partnership for the joint implementation of the research project entitled

A first assessment of the biodiversity of Adamello Glacier

BETWEEN

Comunità Montana di Valle Camonica , Piazza Tassara, 3, Breno (BS), Italy, represented by Alessandro Bonomelli acting in his capacity as the President, hereinafter the "Comunità Montana"

AND

Università degli Studi di Milano, Department of Environmental Science and Policy, Via Festa del Perdono 7, 20122 Milano, Italy, Represented by Prof. Elio Franzini, acting in his capacity of Rector of the Università degli Studi di Milano, hereinafter referred to as the "Lead Partner"

Università degli Studi di Milano Bicocca, Department of Earth and Environmental Science, Piazza dell'Ateneo Nuovo , 1 - 20126, Milano, represented by Prof. Andrea Zanchi, acting in his capacity of Director of the Department (Partner 1)

Università degli Studi di Siena, Department of Life sciences, via Banchi di Sotto 55, 53100 Siena, Italy, represented by Prof. Luca Bini (Partner 2), acting in his capacity of Director of the Department of Life Sciences

Adam Mickiewicz University in Poznań, Department of Animal Taxonomy and Ecology, ul. Wieniawskiego 1 - 61-712 Poznań, Poland represented by vice-rektor prof. Bogumiła Kaniewska (Partner 3)

Referred to singularly as "Party" and Jointly to as the "Parties"

PREMESSO CHE

Il Partner Capofila ha presentato una Proposta di Ricerca alla Comunità Montana di Valle Camonica, intitolata "Una prima valutazione della biodiversità del Ghiacciaio dell'Adamello", descritta dettagliatamente nell'Allegato 1, di seguito denominato "Progetto";

Il Progetto è stato approvato dalla Comunità Montana per il finanziamento con Del. G.E. n._____ in data _____, per un importo totale di 50.000,00 €;

Si intende che il budget assegnato sarà distribuito dalla Comunità Montana alle Parti secondo il Piano di Spesa descritto all'Articolo 4 del presente Accordo;

Le attività del Progetto saranno svolte dal Partner Capofila e dai Partner come indicato nel Progetto;

Le Parti confermano la loro partecipazione al Progetto, in particolare riguardo all'organizzazione del lavoro tra le Parti, alla gestione del Progetto e alla regolamentazione dei loro diritti e obblighi derivanti dal finanziamento, in conformità alle seguenti condizioni.

TUTTO CIÓ PREMESSO, LE PARTI CONVENGONO QUANTO SEGUE

in considerazione dei reciproci impegni stabiliti in questo Accordo, le Parti concordano quanto segue:

1. Scopo

Le Parti si impegnano a svolgere le attività di ricerca in conformità al presente Accordo e in ottemperanza al Progetto e al Budget allegato.
Le Parti si assicureranno quindi di adottare le misure necessarie per raggiungere gli obiettivi pre-assegnati relativi al Progetto con piena autonomia fiscale, amministrativa e operativa. Ciascuna Parte sarà individualmente responsabile del completo adempimento dei compiti e degli obblighi pertinenti specificati nel Progetto.

WHEREAS

The Lead Partner has submitted a Research Proposal to Comunità Montana entitled "A first assessment of the biodiversity of Adamello Glacier" detailed in Annex 1, hereinafter referred to as the Project;

the Project has been approved by Comunità Montana for funding with Act n. _____ dated _____ for a total amount of € 50,000.00 ,

it is understood that the allocated budget will be distributed by Comunità Montana to the Parties according to the Budget Plan as described in Article 4 of the present Agreement;

the Project activities will be performed by the Lead Partner and the Partners as indicated in Project;

The Parties hereby confirm their participation in the Project, in particular concerning the organisation of the work between the Parties, the management of the Project and regulate their rights and obligations arising from the award in accordance with the following terms and conditions.

NOW THEREFORE, THE PARTIES AGREE AS FOLLOWS

in consideration of the mutual promises set forth in this Agreement, the Parties hereby agree as follows

1. Purpose

The Parties undertake to carry out the research activities according to the present Agreement and in compliance with the Project and the Budget enclosed herein.
The Parties will therefore ensure to adopt the necessary measures to achieve the pre-assigned objectives concerning the Project in complete fiscal, administrative and operational autonomy. Each Party will be individually responsible for the complete fulfilment of its relevant tasks and obligations as specified in the Project.

2. Durata

Il presente Accordo entrerà in vigore al momento della firma da parte di tutti i partecipanti al progetto e rimarrà valido per l'intera durata del progetto di ricerca. La validità e gli effetti dell'Accordo termineranno solo quando le Parti avranno adempiuto a tutti gli obblighi relativi alla loro partecipazione al Progetto.

La durata del Progetto sarà di 24 mesi a partire dal 15 luglio 2023 (data di inizio del Progetto).

3. Rappresentanti

Il Capofila designa il Prof. Roberto Ambrosini come responsabile delle attività di ricerca;

L'Università degli Studi di Milano Bicocca designa il Prof. Andrea Franzetti come responsabile delle attività di ricerca;

L'Università degli Studi di Siena designa la Dott.ssa Barbara Valle come responsabile delle attività di ricerca;

L'Università Adam Mickiewicz di Poznań designa il Dott. Krzysztof Zawierucha come responsabile delle attività di ricerca.

Nel caso in cui una Parte intenda sostituire l'individuo/i responsabile/i della collaborazione, l'altra Parte verrà notificata preventivamente per iscritto.

4. Importi e Pagamenti

L'importo totale assegnato dalla "Comunità Montana"al Progetto di Ricerca è di € 50.000 (cinquantamila euro).

La "Comunità Montana" intende distribuire alle Parti il contributo secondo il piano riportato nella tabella indicato di seguito:

2. Duration

The present Agreement shall come into force upon signature by all project participants and remain effective for the duration of the research project. The validity and effects of the Agreement will terminate only when Parties have fulfilled all the obligations concerning their participation in the Project.

The duration of the Project will be 24 months as of July, 15st 2023. (‘starting date of the Project’).

Representatives

The Leading Partner designates Prof. Roberto Ambrosini as principal investigator in charge of the research activities;

Università degli Studi di Milano Bicocca designates Prof. Andrea Franzetti as principal investigator in charge of the research activities;

Università degli Studi di Siena designates Dr Barbara Valle as principal investigator in charge of the research activities;

Adam Mickiewicz University in Poznań designates Dr Krzysztof Zawierucha as principal investigator in charge of the research activities;

In case a Party intends to substitute the individual(s) in charge of the collaboration, the other Party will be notified in advance in writing;

4. Award and Payments

The total amount of the Award assigned by “Comunità Montana” to the Research Project is € 50,000 (fifty thousand)

“Comunità Montana” intends to distribute to the Parties the Award according to the following installment Schedule indicated below:

Partners	**Settembre - September 2024**	**Dicembre - December 2025**	**Totale per partner Total for each**
Capofila - Lead Partner	€ 6000	€ 6000	€12000
Partner 1	€ 8000	€ 8000	€ 16000
Partner 2	€ 6000	€ 6000	€ 12000
Partner 3	€ 5000	€ 5000	€ 10000
Totale - Total	€ 25000	€ 25000	€ 50000

Il trasferimento dei fondi sopra menzionato è soggetto alla ricezione e all'approvazione dei rapporti finanziari e scientifici da parte della Comunità Montana da tutte le Parti, secondo le seguenti scadenze:

1a relazione: settembre 2024

2a relazione (finale): dicembre 2025

Le relazioni devono essere presentate dalle Parti al Responsabile del Progetto 15 giorni prima di ciascuna scadenza sopra indicata. Il Responsabile del Progetto raccoglierà i rapporti per conto dei Partner e li trasmetterà alla Comunità Montana.

5. Riservatezza

Per informazioni riservate si intendono tutti i dati, documenti o altri materiali rivelati o forniti dalle Parti e che al momento della loro divulgazione o fornitura vengono identificati come riservati o di proprietà della Parte che li divulga.

Le informazioni riservate rimarranno di proprietà della Parte che le divulga: nulla di quanto contenuto nel presente accordo potrà essere interpretato come una concessione o implicazione di trasferimento di diritti alla Parte/Parti ricevente, né di brevetti o altri diritti di proprietà intellettuale che proteggono o si riferiscono alle informazioni riservate.

Le Parti si impegnano a utilizzare le informazioni riservate esclusivamente per le attività di ricerca correlate all'implementazione del Progetto di Ricerca oggetto del presente accordo.

The abovementioned transfer of funding is subject to receipt and approval of financial and scientific reports by Comunità Montana by all Parties according to the following deadlines:

1st report: September 2024

2nd report (final) December 2025

The reports are to be submitted by the Parties to the Project Leader 15 days prior to each deadline indicated above. The Project Leader will collect the reports on behalf of the Partners and transmit them to Comunità Montana.

5. Confidentiality

Confidential Information means all data, documents or other material disclosed or supplied by the Partners and which at the time of its disclosure or supply is identified as confidential or proprietary by the disclosing Partner.

Confidential Information shall remain the propriety of the Disclosing Partner: Nothing contained herein shall be construed as granting or implying any transfer or rights to the receiving Partner/Parties, or any patents or other intellectual property protecting or relating to the Confidential Information

The Parties undertake to use Confidential Information only for research activities related to the implementation of the Research Project concerning the present agreement.

Le Parti si adopereranno per preservare il segreto e la riservatezza delle informazioni riservate e non le divulgheranno a terzi né le renderanno pubbliche o accessibili in alcun modo, salvo previo consenso scritto della Parte che le divulga.

Tuttavia, gli obblighi di riservatezza non si applicano a dati, documenti o altri materiali che:
- Al momento della ricezione da parte della Parte ricevente, sono di dominio pubblico;
- Vengono pubblicati o diventano parte del dominio pubblico dopo la ricezione, senza colpa della Parte ricevente (ma solo dopo che, e solo nella misura in cui, sono pubblicati o diventano parte del dominio pubblico);
- Erano già in possesso della Parte ricevente (come documentato dai registri scritti della Parte ricevente) al momento della ricezione e non sono stati acquisiti, direttamente o indirettamente, dalla Parte che le divulga;
- Sono stati ricevuti dalla Parte (come documentato dai registri scritti della Parte ricevente) da un terzo che non richiedeva alla Parte ricevente di mantenerli riservati e che non li aveva acquisiti, direttamente o indirettamente, dalla Parte che le divulga ai sensi di un obbligo continuativo di riservatezza.

6. Proprietà Intellettuale e Disseminazione

Ogni informazione esistente e diritto di proprietà intellettuale, know-how e/o invenzioni detenute dalle Parti prima del Progetto sono di loro esclusiva proprietà e non sono influenzati da questo Accordo. Nessun'altra Parte avrà alcun diritto o pretesa su tali proprietà intellettuali, industriali o commerciali, know-how e/o invenzioni dell'altra Parte.

I risultati derivanti dal lavoro svolto nell'ambito del Progetto saranno di proprietà della Parte che ha svolto il lavoro che ha portato a tali risultati.

The Parties shall use all reasonable efforts to preserve the secrecy and confidentiality of the Confidential Information and shall not disclose it to any third party or make it publicly available or accessible in any way, except with the prior written consent of the disclosing Partner.

The obligations of confidentiality shall not apply, however, to data, documents or other material which:
- Is at the time of receipt by the receiving Partner in the public domain;
- Is published or otherwise becomes part of the public domain after receipt through no fault of receiving Partner (but only after, and only to the extent that, it is published or otherwise becomes part of the public domain);
-Was already within receiving Partner's possession (as is evidenced by receiving Partner's written records) at the time of receipt and was not acquired, directly or indirectly, from disclosing Partner; or
- Was received by Partner (as is evidenced by receiving Partner's written records) from a third party who did not require receiving Partner to hold it in confidence and who did not acquire it, directly or indirectly, from disclosing Partner under a continuing obligation of confidence;

6. IPR and Dissemination

Any existing information and intellectual property rights, know-how and/or inventions held by Parties prior to the Project is their sole and separate property, and is not affected by this Agreement. Any other Party will not have any claim to or right in such existing intellectual, industrial or commercial property, know-how and/or inventions of the other Partner

The Results arising from work under the Project shall be the property of the Party carrying out the work that generates such Results.

Nel caso in cui i risultati siano creati o generati congiuntamente da due o più Parti e non sia possibile separare il contributo intellettuale di ciascuna Parte nella creazione della Proprietà Intellettuale derivata, la Proprietà Intellettuale derivata sarà di proprietà congiunta delle Parti ("Joint Owners"). Essi dovranno concordare tra di loro in un ulteriore accordo l'assegnazione e le modalità di esercizio della proprietà dei suddetti risultati.

Where Results are created or generated by the two or more Parties jointly and it is impossible to segregate each Party's intellectual contribution to the creation of the Arising Intellectual Property, the Arising Intellectual Property will be jointly owned by the parties (the "Joint Owners"). They shall agree among themselves in a further agreement on the allocation and the terms of exercising the ownership of said Results.

Se i risultati delle attività di ricerca generate nel presente Accordo dovessero portare a un'invenzione brevettabile, le Parti stipuleranno un accordo separato che disciplina la domanda di brevetto; in tale accordo le Parti stabiliranno le modalità di brevettazione congiunta, la gestione e lo sfruttamento commerciale dei risultati e la pubblicazione dei risultati della ricerca avverrà solo dopo che le Parti avranno adempiuto a tutte le procedure necessarie per proteggere tali risultati brevettabili.

If the results of the research activities generated in this present Agreement should lead to a patentable invention, the Parties will enter into a separate agreement regulating the patent application; in such agreement the Parties will establish the terms of the joint patenting, the management and commercial exploitation of the results and the publication of the research results will be done only after the Parties have complied with all the procedures which are needed in order to protect such patentable results.

La diffusione dei risultati, comprese le pubblicazioni e le presentazioni, sarà regolata come segue:
- Sarà fornito un preavviso di almeno 45 giorni civili alle altre Parti per qualsiasi pubblicazione pianificata.
- Eventuali obiezioni alla pubblicazione pianificata dovranno essere presentate con preavviso scritto alla Parte Capofila e alla Parte o alle Parti che propongono la diffusione entro 30 giorni civili dalla ricezione del preavviso. Se nessuna obiezione viene sollevata entro il termine indicato sopra, la pubblicazione è consentita.

The dissemination of Results including but not restricted to publications and presentations, shall be governed as follows:
- prior notice of any planned publication shall be given to the other Parties at least 45 calendar days before the publication.
- Any objection to the planned publication shall be made with prior written notice to the Lead Partner and to the Party or Parties proposing the dissemination within 30 calendar days after receipt of the notice. If no objection is made within the time limit stated above, the publication is permitted

Le Parti concordano che i risultati saranno pubblicati preferibilmente su riviste in accesso aperto (Open Access) e collaboreranno con GLACIER HUB https://blogs.ei.columbia.edu/features/glacierhub/ per dare visibilità internazionale in modo intelligente e popolare ai risultati del progetto. Alla fine del progetto, tutti i dati saranno resi pubblicamente disponibili in repository ad accesso aperto, ad esempio DataVerse.

The Parties agree that results will be published on scientific papers preferentially on Open Access journals and cooperate with GLACIER HUB https://blogs.ei.columbia.edu/features/glacierhub/, to give international visibility to the project results smartly and popularly. At the end of the project, all data will be made publically available in open access repositories, e.g. DataVerse.

7. Responsabilità

Ogni Parte si impegna a partecipare all'efficace implementazione del Progetto, a collaborare, eseguire e adempiere tempestivamente e puntualmente a tutti i suoi obblighi come ragionevolmente richiesto e in buona fede.

Ogni Parte si impegna a notificare tempestivamente a Comunità e alle altre Parti, in conformità con la struttura di governance del Progetto, qualsiasi informazione significativa, fatto, problema o ritardo suscettibile di influenzare il Progetto.

Nessuna Parte sarà responsabile nei confronti di un'altra Parte per eventuali perdite indirette o danni consequenziali o simili, come ad esempio la perdita di profitto, la perdita di ricavi o la perdita di contratti, a condizione che tale danno non sia causato da un atto volontario.

La responsabilità contrattuale di una Parte nei confronti delle altre Parti in via aggregata sarà limitata alla quota della Parte dei costi totali del Progetto come identificati nel presente Accordo, sempre che tale danno non sia causato da un atto volontario.

Le disposizioni del presente Accordo non devono essere interpretate come una modifica o limitazione della responsabilità legale di una Parte.

8. Copertura assicurativa

Ogni Parte garantisce una copertura assicurativa per infortuni e per responsabilità verso terzi per il proprio personale impiegato nelle attività oggetto del presente contratto.

7. Responsibility

Each Party undertakes to take part in the efficient implementation of the Project, and to cooperate, perform and fulfil, promptly and on time, all of its obligations as may be reasonably required from it and in a manner of good faith.

Each Party undertakes to notify promptly Comunità and the other Parties, in accordance with the governance structure of the Project, of any significant information, fact, problem or delay likely to affect the Project.

No Party shall be responsible to any other Party for any indirect or consequential loss or similar damage such as, but not limited to, loss of profit, loss of revenue or loss of contracts, provided such damage was not caused by a willful act.

A Party’s contractual aggregate liability towards the other Parties collectively shall be limited to once the Party’ share of the total costs of the Project as identified in this Agreement provided that such damage was not caused by a willful act.

The terms of this Agreement shall not be construed to amend or limit any Party’s statutory liability.

8. Insurance coverage

Each Party guarantees insurance coverage against injury and third-party liability insurance for its own staff engaged in the activities that are object of the present contract.

9. Disposizioni relative alla prevenzione, sicurezza e tutela della salute

Ogni Parte garantisce misure generali e specifiche per la protezione della salute del personale dell'altra parte che è ospitato presso i propri locali e impegnato nelle attività relative all'adempimento della presente collaborazione, nonché adempimenti aggiuntivi che la normativa vigente impone all'obbligo del datore di lavoro in materia di prevenzione, sicurezza e tutela della salute.

Il personale di ciascuna Parte e i relativi membri coinvolti sono obbligati a osservare le disposizioni in materia di prevenzione, sicurezza e tutela della salute impartite dall'ente ospitante.

10. Legge applicabile - Risoluzione delle controversie

La validità, l'esecuzione, l'inadempienza, l'interpretazione e la risoluzione del presente Accordo saranno disciplinati dalla legge italiana.

Tutte le controversie derivanti dal presente Accordo, che non possono essere risolte in via amichevole riguardo all'interpretazione, all'esecuzione e alle conseguenze, saranno deferite alla giurisdizione del tribunale di Milano (Italia).

11. Protezione dei dati personali

Le Parti si impegnano a rispettare tutte le leggi e i regolamenti applicabili in materia di protezione dei dati personali, in particolare il Regolamento (UE) 2016/679 sulla "protezione delle persone fisiche con riguardo al trattamento dei dati personali e sulla libera circolazione di tali dati" (di seguito "GDPR").

Il termine "dati personali" avrà lo stesso significato di quanto stabilito nell'articolo 4 del GDPR.

9. Regulations regarding prevention, safety and safeguard of health

Each Party ensures general and specific measures for the protection of the health of the staff of the other party that is hosted in its premises engaged in the activities regarding the fulfilment of the present collaboration, and also additional fulfilments that the current legislation places under the obligation of the employer regarding prevention, safety and safeguard of health.

The staff of each Party and any relevant members involved are obliged to observe the regulations regarding prevention, safety and safeguard of health of the staff imparted by the hosting body.

10. Governing law- Dispute resolution

This Agreement's validity, performance, non-performance, interpretation and termination shall be governed by Italian Law.

All disputes arising from this Agreement, which cannot be solved amicably concerning interpretation, performance and consequences shall be referred to the jurisdiction of the court of Milan (Italy).

11. Protection of persona/ data

The Parties agree to comply with all applicable laws and regulations related to the protection of persona! data, in particular the (EU) Regulation 2016/679 on the "protection of natural persons with regard to the processing of persona/ data and on the free movement of such data" (hereinafter "GDPR").

The term "personal data" shall have the same meaning as in the article 4 of the GDPR.

Ogni Parte utilizzerà i dati personali comunicati dall'altra Parte solo per gli scopi per i quali sono stati raccolti (il Progetto di Ricerca). Ciascuna Parte proteggerà tali dati personali da trattamenti illeciti o non autorizzati e garantirà la loro sicurezza mediante l'adozione di adeguate misure tecniche e organizzative per garantire un livello di sicurezza adeguato al rischio.

Each Party shall use any personal data disclosed by the other Party only for the purposes for which they have been collected (the Research Project). Each Party shall protect such personal data against unlawful or unauthorized treatment, and maintain its security by implementing appropriate technical and organizational measures to ensure a level of security appropriate to the risk

Il presente Accordo è redatto in 5 copie originali con testo parallelo in inglese e italiano, aventi entrambi lo stesso valore legale.

This Agreement is executed in 5 original copies with parallel text in English and Italian , both having the same legal value.

Annessi
Gli Allegati elencati in calce sono parte integrante di questo Accordo.

Allegato 1: Progetto di ricerca
Allegato 2: Modulo coordinate bancarie Partner

Annexes
The Annexes listed below are an integral part of this Agreement:

Annex 1: Project;
Annex 2: Partner Bank Form detail

Per la Comunità Montana di Valle Camonica
Il Rappresentante Legale
Il Sig….Alessandro Bonomelli

Per il Capofila / For the Project Leader
Università degli Studi di Milano
Il Rettore / The Rector
Prof. Elio Franzini

Per il Partner 1 / For Partner 1
Università degli Studi di Milano Bicocca
Il Direttore del Dipartimento di Scienze della Terra e dell'Ambiente / The Director of the Department of Earth and Environmental Science
Prof. Andrea Zanchi

Per il Partner 2 / For Partner 2
Università degli Studi di Siena
Il Direttore del Dipartimento di Scienze della Vita / The Director of the Department of Life Sciences
Prof. Luca Bini

Per il Partner 3 / For Partner 3
Adam Mickiewwicz University in Poznan’
Department of Animal Taxonomy and Ecology
The vice-rektor
Prof. Przemysław Wojtaszek,

ANNEX 1 Project

A first assessment of the biodiversity of Adamello Glacier

(duration: 24 months)

Abstract

Although glaciers and ice sheets have been considered almost lifeless environments for a long time, they are now recognized as ecosystems teeming mostly with microbial life, but also hosting larger organisms. However, our current knowledge of glacier ecosystems is poor and fragmented. Their biodiversity is likely much larger than what can be expected and only very preliminary attempts have been made to fully describe the trophic interactions and the ecological interconnections among the different environmental compounds of a glacier ecosystem. Importantly, the fast shrinkage of glaciers due to climate change is making this biodiversity disappear in front of us before we even know it, and we may be the last generation that has the opportunity to study these vanishing ecosystems.

To fill this large gap of knowledge, the present project aims at describing at an unprecedented level of detail, the vast biodiversity of the largest Italian glacier, the Adamello. The information obtained could also help shed light on glacier ecological webs.

The Adamello Glacier biodiversity will be investigated by an integrated set of morphological and molecular methods (including DNA barcoding and genetic analyses). The research team includes glaciologists, microbiologists, botanists, zoologists and ecologists who are leading experts in glacier ecology in Italy, have a long experience in working on glaciers, and have all the diverse skills necessary to achieve the objectives of the project successfully.

The results obtained can have direct application for planning conservation actions for these imperilled and rapidly changing ecosystems also included among those deserving urgent conservation attention according to the EU Habitat Directive (92/43/EEC - 1992).

The dissemination of the results will target both the scientific community, with the publication of scientific papers in leading scientific journals and the participation to scientific congresses, and the public, through the writing of papers for popular magazines. Glaciers are able to fascinate people with the magnificence of their landscapes and are therefore an asset to engage people in nature conservation because these environments urgently need protection before they are lost forever.

1. Background

Glaciers have long been considered almost lifeless environments, but this view does not correspond to reality. In recent years, they have been recognized as ecosystems in their own right, teeming mostly with microbial life, but also hosting larger organisms (e.g. rotifers, tardigrades, plants and arthropods [1]). Globally, glaciers and ice sheets harbour an estimated 10^{29} microbes [2] that carry on important ecosystem processes, like carbon fixation occurring at rates that are relevant on the scale of the global carbon cycle [3]. The biodiversity hosted by glaciers may be much higher than expected for apparently lifeless environments. For instance, different ground-dwelling arthropod assemblages are found on glaciers located in different mountain groups due to the low dispersal ability of some species and consequent biogeographic isolation [4]. In addition, a study conducted in the central Alps has revealed large differences in bacterial communities among four glaciers less than 3 km apart [5] and preliminary results on 11 glaciers distributed worldwide suggest that each glacier hosts distinct bacterial communities (our unpublished results), which also show complex seasonal dynamics and year-to-year variability [6]. The existence of a large, mainly neglected, biodiversity is supported also by the large diversity of microbial metabolic pathways that have been documented on glaciers. For instance, besides oxygenic photosynthesis, chemoautotrophic carbon fixation and anoxygenic phototrophy also occur on glaciers [1, 7], and preliminary evidence suggests that chemosynthesis by H_2 oxidation might represent another relevant energy and C input process [8, 9].
Despite the likely existence of large, neglected biodiversity, our current knowledge of glacier ecosystems is poor and fragmented. Most studies conducted so far focussed on peculiar supraglacial habitats like cryoconite holes - small ponds filled by meltwater with sediment on the bottom - which are considered

hotspots of biodiversity on glaciers, supraglacial moraines, or the debris cover of debris-covered glaciers. In these supraglacial habitats, cyanobacteria are the predominant photosynthetic primary producers, while different algal taxa dominate ice (*Ancylonema* spp. and *Mesotaenium* spp.) and snow (*Chlamydomonas nivalis*) [10, 11]. Those organisms can lower the surface albedo of the glacier and increase the presence of liquid water in the supraglacial environments [10] Invertebrates, mostly connected with aquatic/wet habitats, such as springtails (Collembola), non-biting midges (Diptera: Chironomidae) and stoneflies (Plecoptera), can live directly on the ice surface [12, 13] and feed on supraglacial biofilm and dead organic matter. Despite the key role of springtails and non-biting midges in this habitat, because of their abundance and trophic role, our knowledge of the taxonomy and distribution of these two groups is still very fragmentary. In addition, on glaciers, ground-dwelling and sheet weaver spiders (Lycosidae and Lyniphiidae) and ground beetles (Carabidae) are the predominant predators, at the apex of this invertebrate food web [12], feeding mainly on springtails and non-biting midges. An important role is also played by allochthonous organic matter, while vascular plants and bryophytes may locally act as important primary producers on the supraglacial debris.

No comprehensive studies of the biodiversity hosted by glaciers currently exist. This general lack of knowledge is particularly worrying because glaciers are retreating at an increasing rate due to climate change. In Italy only, the overall glacier surface decreased by 30% between the 1960s and 2000s [14] and a further 11% was lost from the 2000s to 2010s [15]. A potentially large amount of biodiversity is therefore disappearing in front of us without being even recognized. Importantly, we may be the last generation that has the opportunity to study such still neglected biodiversity [16] because glaciers in the Alps, which are currently acting as refuge areas for cold-adapted species, are predicted to steadily decline with only between 33% and 5% of the present volume remaining at the end of this century depending on the climate change scenario [17].

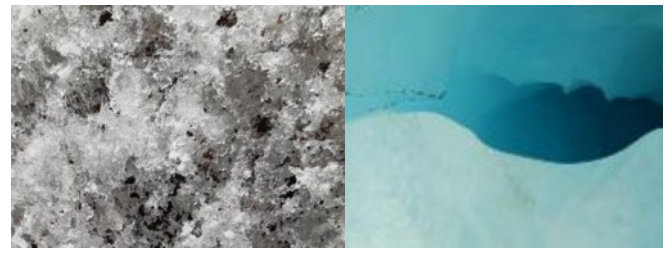
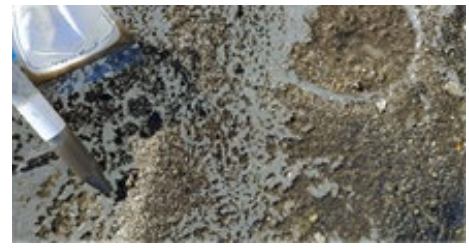
Among the different habitats that can be recognized on a glacier, this project will focus on the supraglacial ones. Indeed, the investigation of the englacial and subglacial habitats (i.e. the organisms that live in the ice mass or the sediments at its bottom) requires peculiar methods that are outside the scope of this project. The expected results will contribute to a deeper understanding of the biodiversity and functioning of Italian glacier ecosystems and an assessment of the potential loss of biodiversity due to their shrinkage.

2. Detailed description of the project:

2.1 Aims and overview of the sampling design

This project aims to describe the biodiversity of the supraglacial zone of the Adamello glacier with full state-of-the-art taxonomic and molecular methods. On the surface of a glacier, different supraglacial habitats (SHs) can be recognized. Tab. 1 summarizes their main characteristics.

Table 1: supraglacial habitats potentially occurring on Adamello glacier and their main characteristics.

Supraglacial habitat (SH)	Description	Pictures
Ice surface	Superficial ice layer, including the “weathering crust” i.e. a permeable ice layer due to enlargement of inter-crystal voids by solar radiation	
Sparse cryoconite	Powdery windblown dust made of small rock particles, soot and microbes deposited on ice and snow	
Cryoconite holes	Small ponds filled with meltwater and powdery cryoconite (a mixture of organic and mineral matter)	
Coarse debris	Thick deposits of coarse supraglacial debris, including the supraglacial moraines and the thick debris cover above the glacier front	
Dirt cones	Convex structures with a core of ice, snow, or firn covered by a thin layer of fine material (sometimes called “supraglacial kames”).	
Snow and firn	Snow and partially compacted and recrystallized snow	

Each SH hosts a different ecological community, but some organisms, particularly the largest ones, can move along the glacier, visiting different SHs (Fig. 2).

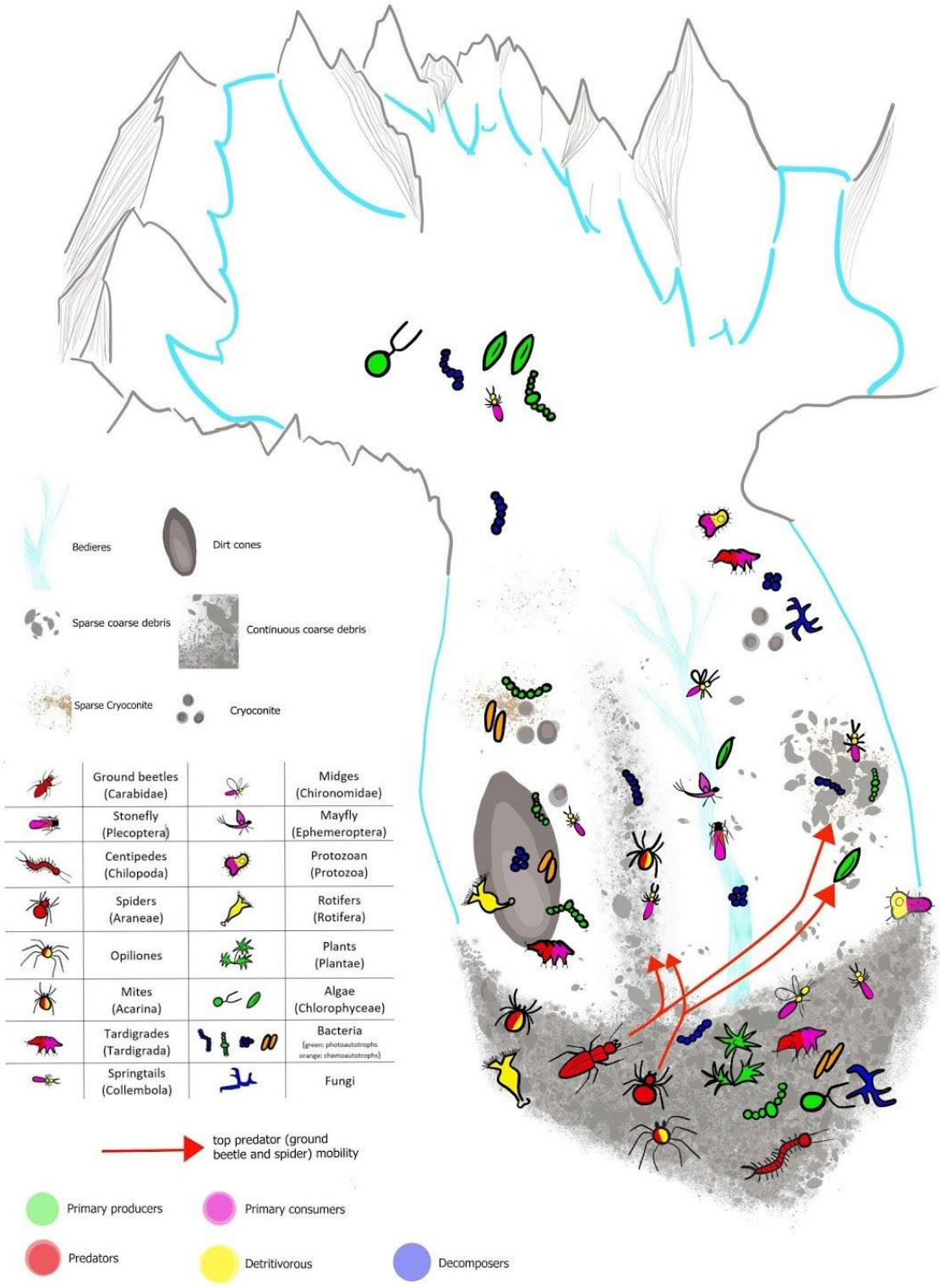


Figure 2: schematic representation of the supraglacial habitats and the organisms they can host.

To collect information on the glacier biodiversity while accounting for the different home ranges of organisms of different sizes, we will identify at least three 20 x 20 m squares (cells). A preliminary visit will be performed to accurately place the cells. The sampling will be performed twice during the ablation season for two consecutive years, at the beginning (shortly after snowmelt: early/mid-July) and in the second half of the ablation season (mid/late August).

2.2. Sampling protocols

SHs at each cell will be sampled by Servizio Glaciologico Lombardo in the framework of their agreement with Adamello Park according to the following protocols.

2.2.1 Ice surface

The first 2-3 cm of superficial ice will be collected with the help of a sterilized stainless-steel shovel from 3-5 spots per cell for a total of ~0.5 L in sterile plastic bags. The presence of springtails moving on the ice surface will be checked in 10 spots corresponding to ice depression and concavities.

2.2.2 Sparse cryoconite

50 mL Falcon tubes will be filled using a sterilized spoon for molecular and microscopy analyses from 3-5 randomly selected spots within each cell.

2.2.3 Cryoconite holes

Cryoconite (> 2 g) will be collected in 15 mL falcon tubes for molecular and microscopy analyses from 10 cryoconite holes within each cell. From the same holes, 1-3 samples will be collected for benthic invertebrate analyses according to [18] from the bottom of the hole with a separate plastic pipette and transferred into a plastic test tube. All springtails present will be collected with an insect aspirator as usually, only a few individuals occur in this SH.

2.2.4 Coarse debris

3-5 samples of continuous coarse debris will be collected as in 2.2.2. Ground-dwelling arthropods will be quantitatively sampled through pitfall trapping: at least 3 pitfall traps, located 10 m apart, per cell [19]. On continuous coarse debris, the floating method [20] will also be used to collect endogean species (i.e. springtails). Vascular and non-vascular plants will be sampled wherever possible. Small pieces of bryophytes will be collected, placed in paper envelopes and allowed to dry slowly.

2.2.5 Dirt cones

3-5 samples will be collected as in 2.2.2. Ground-dwelling arthropods will be collected by hand searching with an insect aspirator as in 2.2.4. Springtails will be collected through the floating method as in 2.2.4.

2.2.8 Snow and firn

2 L of snow or firn will be collected for molecular and microscopy analyses with the help of a sterilized shovel in sterile plastic bags. Ground-dwelling arthropods will be collected by hand searching as in 2.2.4. Springtails will be collected through the floating method (see 2.2.5).

2.3 Laboratory analyses

The large number of widely different samples collected in the field will be investigated with an integrated set of state-of-the-art laboratory methods to fully characterize the biodiversity of the glaciers thus fulfilling the first main aim of the project.

2.3.1 Microbiological molecular analyses

Samples for molecular analyses (2.2.1-2.2.8) will be kept cold during the transport and then stored at -20°C. The samples from the same SH of the same cell will be pooled together and 3 aliquots of the pool will be used for the subsequent analyses. This procedure is necessary because the number of collected samples will be too large to analyse them separately in the time and budget limits of the project. DNA will be extracted from 0.5 g of each type of sediment with commercial kits. Water samples from melted ice, firn or snow will be filtered in 0.22 µm polycarbonate membrane filters, before DNA extraction.

Bacterial and algal communities will be characterized by PCR amplification of the V5-V6 hypervariable region of the bacterial 16S rRNA gene and the V4-V5 hypervariable region of the 18S rRNA gene respectively [6, 10]. Fungal communities will be characterized by sequencing the Internal Transcribed Spacer 1 (ITS1) region as suggested in [21].

Amplicons will be sequenced with the MiSeq Illumina platform, using a 2×250 bp paired-end protocol. Reads will be demultiplexed according to the indexes. Sequences will be grouped in Amplicon Sequence Variants (ASVs) with DADA2 [22] and classified with RDP classifier [23] for both bacterial and fungal sequences and with SILVA 132 SSURef Nr 99 database [24] for algal sequences.

Results from these analyses will be used to create radiative transfer model simulations (i.e. BioSNICAR, [25]) to calculate the possible albedo-reducing effect of supraglacial algal biodiversity.

2.3.2 Morphological classification of organisms

All invertebrates sampled will be preserved in 75% ethanol for transport and identified to the species (Springtails, Arachnids, Carabids) or higher taxonomic level (Chironomids, other beetles, Chilopoda) by stereomicroscope (50x) and a microscope (1000x) after setting permanent slides. Springtail, tardigrade and rotifer identification will be made at the species level with an integrative taxonomy [18, 26], combining evidence from morphology (at the microscope) and DNA barcoding of COX1 and 28S rDNA genes [20].

Vascular plants and bryophytes will be identified wherever possible in the field. Unidentified specimens will be sampled and identified afterwards through identification keys. Bryophytes will be sampled and air-dried for subsequent identification, which will be carried out after rehydration in the laboratory at a light microscope and through identification keys.

2.4 Ecological interactions and functional diversity

The information on biodiversity gathered in this project will allow for assessing the ecological interactions (particularly food webs) and the functional diversity of glacier ecosystems. Based on previous knowledge, we hypothesise different taxa play the roles depicted in Fig. 3.

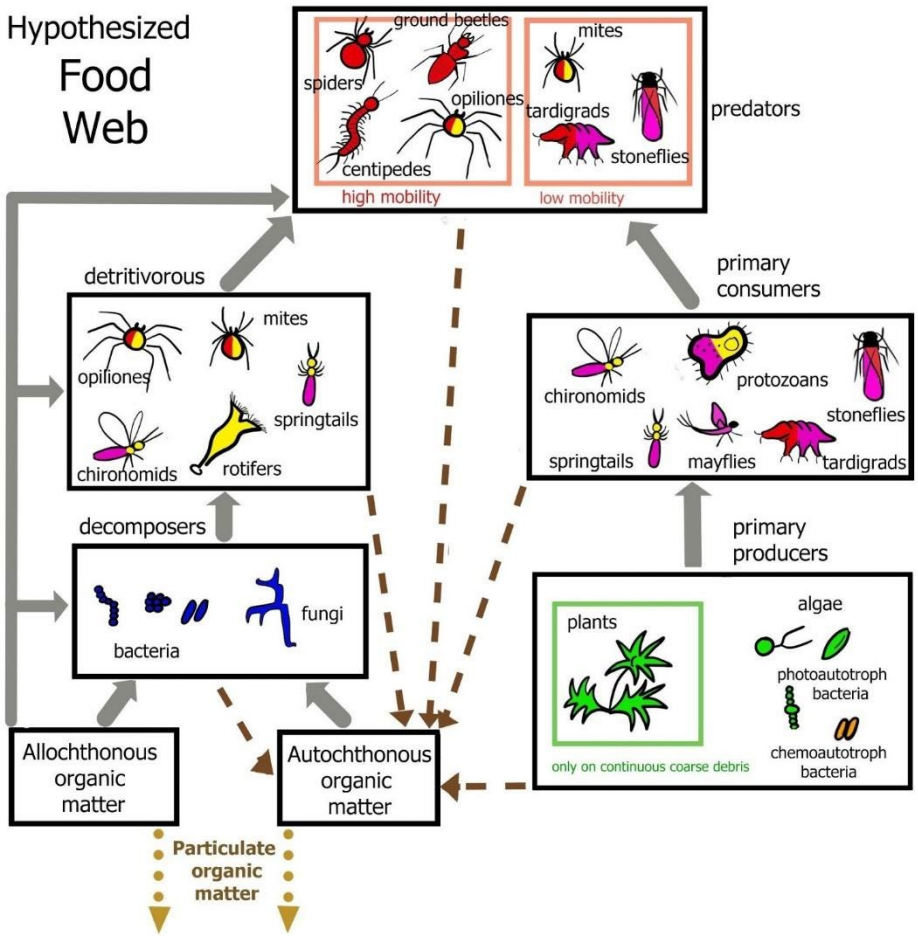


Figure 3: hypothesized ecological interactions and glacier food web.

Information on taxonomic diversity (obtained through morphologic identification or eDNA or DNA metabarcoding) will also be linked with available information on the traits of detected organisms (obtained from databases and the literature) to reconstruct their ecological (trophic) role in the ecological network.

2.5 Contamination

Glacier biodiversity can be threatened by the presence of different legacy and emerging contaminants reaching these ecosystems from local or diffuse sources. Among the emerging contaminants, microplastics (MPs) raised particular concern because they have been recently found on glaciers [27], where they can be ingested by different organisms and enter the trophic chain [28]. Increased melting rates fostered by climate change, are remobilizing atmospheric pollutants that have been stored in glaciers for decades. Glaciers are now acting as secondary sources of legacy pollutants emitted decades ago. Among them, radionuclides play an important role, as it has been observed that before being released by the glacier, they accumulate at the glacier's surface and in particular in cryoconite. The highest activity concentrations of natural and artificial radionuclides, excluding sites where nuclear accidents and tests occurred, have been found in cryoconite [29].

The occurrence and distribution of MPs will be investigated by collecting at least three samples per cell in the same cells used for biodiversity sampling. MPs will be isolated and characterized according to protocols implemented in our previous works [30].

Radionuclides will be determined in cryoconite samples through gamma-spectrometry. At least 5 samples from each of the considered cells will be analyzed. Attention will be given to the different morphologic features of cryoconite deposits, as it has been observed that the presence/absence of granules, colour, shape, and abundance of meltwater are all features that influence the accumulation of radionuclides in cryoconite [31]. Dry samples (~5 g) will be measured with HyperPure Germanium Detectors, allowing the analysis of natural and artificial gamma-emitting radionuclides.

2.6 Expected results

Thanks to the integrated use of a wide set of analytical methods we will be able to answer the following questions:

- *What, and how many taxa live on Adamello Glacier?* We will provide the first open-source georeferenced database of the supraglacial biodiversity of an Italian glacier.
- *Do endemic species exist on Adamello? How many glacier-specialist and endemic species are endangered due to climate change?* Little information on this topic is currently available.
- *How much glacier biodiversity will be lost in the next decades due to climate change?* Based on species distribution and species life-history traits we will estimate the probability of species persistence in the medium and long term.
- *What is the structure and robustness of the ecological webs?* We expect to provide insights into the interactions among taxa, a topic for which very little information is currently available
- *Might biodiversity be affected by microplastic contamination?* We will provide insight into the occurrence and distribution of microplastics that might be ingested and spread by organisms on the glacier surface and down-valley ecosystems.
- *Might biodiversity be affected by radionuclide contamination?* It is known that cryoconite accumulated at the surface of glaciers is extremely rich in natural and artificial radionuclides, but until now it is not known if such a radioactive burden is affecting the biological activity of cryoconite. Thanks to the multi-disciplinary dataset provided by the present project, it will be possible to shed light on this poorly known phenomenon related to the contamination of glaciers.
- *Might biodiversity affect the albedo of the Adamello glacier?* The concept of bio-albedo feedback has been recently proposed to describe the impact of algae and cryoconite on the surface balance of glaciers. In this project, radiative transfer simulations will be conducted for estimating the effect of supraglacial biodiversity (in particular algae) on the albedo of the Adamello glacier.

2.7 Dissemination

Developing solutions to today's challenges such as the climate crisis and biodiversity loss requires putting together the needs of public, scientific, and commercial stakeholders [45]. To this end, we have planned different ways to share our results. In particular, we will publish at least an Open Access scientific paper and cooperate with GLACIER HUB https://blogs.ei.columbia.edu/features/glacierhub/, to give international visibility to the project results smartly and popularly.

3 – **Project development**.

The project will be developed in two years during the ablation season, starting June 2023 (see Gantt diagram in Fig. 4). The project includes two field seasons in July-September of each year, and samples will be analysed in the following months.

			Fieldwork		Laboratory analyses			Outputs	
Activity →		Administrative procedures	Fieldwork organization (including cell identification)	Fieldwork activities	Microbiological molecular analyses	Morphological classification	Gut content analyses	Data elaboration	Dissemination
2023	J								
	J								
	A								

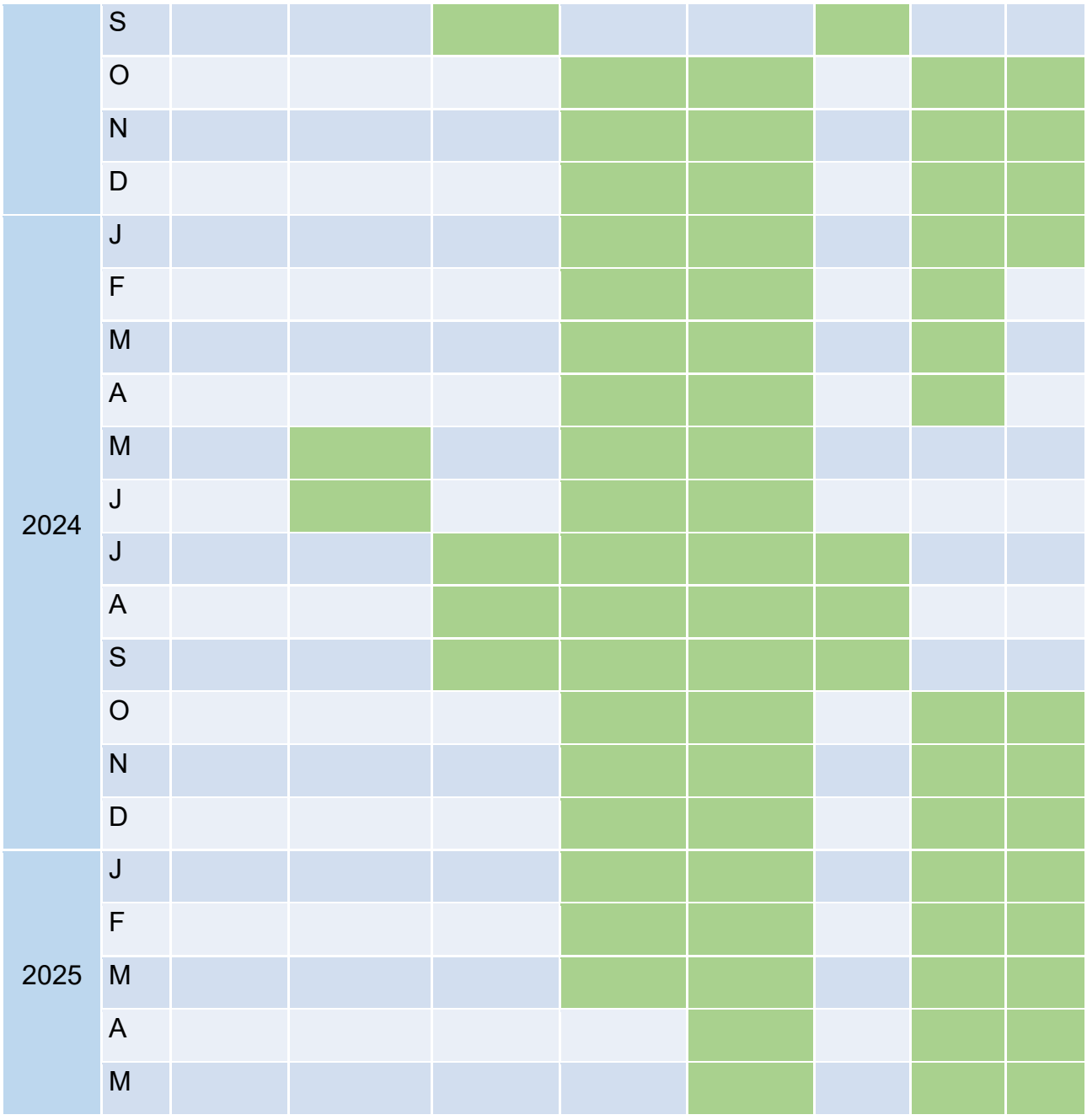


Figure 4: Gantt diagram of the project

4. Possible applications

This project will provide the necessary data to exhaustively describe the Adamello supraglacial ecosystem and its biotic communities. The main output will be the first quantitative inventory of the biodiversity of an Italian glacier and the first assessment of the network of the ecological interactions (particularly the trophic ones) among different communities inhabiting this environment. The closer application we foresee is in the field of biodiversity conservation. Indeed, despite considerable progress in climate change biology and alpine ecology, mountain glaciers remain one of the most understudied, yet arguably most imperilled and rapidly changing, ecosystems on Earth [1]. Indeed, they have all the features to be included among the ecosystems deserving urgent conservation attention and biodiversity monitoring programs, particularly because they are disappearing at an increasing rate. According to European law, they are protected by the Habitat Directive under the habitat type “Permanent Glaciers - Code 8340” (Council Directive 92/43/EEC - 1992). However, only a fraction of the surface currently covered by permanent glaciers is included in the Natura2000 network, leaving a significant fraction of Habitat 8340 actually unprotected. The detailed

description of the biodiversity and of the ecological webs of glacier ecosystems provided by this project will thus serve as an important base of knowledge for future conservation plans for these habitats.

We remark that we are completely aware of the ethical constraint of a project aimed at investigating vanishing biodiversity but removing part of it for scientific purposes, and we planned “low impact” field surveys in terms of sampling methods, sampling duration, number of spatial and temporal samples/replicates (see 2.2). The sampled biological material will be deposited at the MUSE-Science Museum of Trento (Italy), with which UNIMI has active collaborations and that already hosts the largest Italian collection (>500k specimens) of invertebrates and algae collected in glaciated areas [32] as a memory of the past glacial biodiversity.

The unknown biodiversity of glaciers may also provide important ecosystem services. For instance, high-elevation cold environments act as traps for volatile and semi-volatile contaminants that can accumulate on glaciers, and it has been demonstrated experimentally that bacteria and other organisms living in supraglacial habitats are able to degrade recalcitrant organic pollutants that arrive on glaciers after medium-range atmospheric transport [46, 47]. Interestingly, on glaciers, some of these substances can be degraded at a much faster rate than what can be expected due to the low environmental temperature [46]. This project will thus provide a contribution to planning future detailed investigations on pollutant degradation in cold environments, which may also have biotechnological applications.

Among the emerging contaminants, microplastics currently raise particular concern because they have been found also on glaciers [27]. They are probably deposited from atmospheric transport, but their fate on glaciers and in the surrounding environments, especially in down valley ecosystems, is still unknown. These particles can be ingested by different organisms and enter the trophic chain [28]. In addition, they can adsorb and spread other pollutants across ecological webs. The information on glacier food webs provided by this project may give further insights into the environmental fate of microplastics and other contaminants on high mountains.

Finally, glaciers are contaminated also by radionuclides deriving from atmospheric fallout of particles from nuclear plant accidents or atomic tests to a higher extent than the surrounding environments [29]. Radionuclides are found particularly in cryoconite, which, for reasons that are still debated, seems able to efficiently concentrate them. Given that cryoconite holes are considered hotspots of biodiversity on glaciers, radionuclides accumulated in them may potentially spread across the glacier trophic webs. However, our lack of knowledge on the ecological interactions of glacier ecosystems currently limits our ability to assess how harmful these effects can be for the glacier, the down valley ecosystems, or the nearby areas. The information provided by the current project could help in shedding light on these topics.

Glaciers are also important for humans, particularly for provisional (as a source of water for agriculture, hydropower and consumption) and cultural (including recreational, e.g. tourism, and theatres of World War I) ecosystem services [12, 32, 33]. Mountains are an important part of our life. Italy is a country that has a great mountaineering history and that tried, so far, to protect its mountains to give everybody the chance to appreciate their beauty. However, currently, we do not know how glacier loss will affect not only the image of today’s mountains but also their ecology. It is, therefore, necessary to investigate how climate change is affecting our glaciers as long as we can, because we may be the last generation to have this chance.

Altogether, these results will provide all the information concerning both the biodiversity and the contamination of this glacier. This information will be translated into useful guidelines accessible to the public.

5. Brief description of the research staff

Glacier environment is not easy to access and requires proper training before the research staff can work safely. All the researchers involved in this project already have a sound experience in these environments, as proved by their publications and curricula.

The PI **Prof. Roberto Ambrosini** (male, ORCID: 0000-0002-7148-1468, 167 indexed publications, h-index = 37) is currently an associate professor of Ecology at the Department of Environmental Science and Policy

(ESP), has sound experience in organizing and conducting field works in glacial environments, as he made several sampling campaigns on glaciers in the Alps, Andes, Himalaya, Karakoram and the Arctic.

Analysis on springtails, bryophytes and vascular plants will be performed by **Barbara Valle** (female, ORCID ID 0000-0003-4829-4776, 8 indexed scientific publications, h-index: 4) currently a researcher at the University of Siena (Italy). She works on supraglacial communities of springtails, plants and ground beetles, with reference to climate change's impact on high-altitude communities. Her expertise includes springtail and ground beetle sampling and identification, assessment of the functional and ecological profile of springtail species, and flora and vegetation sampling and analysis.

Microplastic analysis will be performed under the lead of **Prof. Marco Parolini** (male, ORCID ID: 0000-0003-0226-1709, 151 indexed scientific publications, h-index: 33), currently an associate professor of Ecology at the Department of Environmental Science and Policy (ESP), who has a sound experience in the analysis of contamination of mountain environments, particularly by microplastics, with the contribution of **Arianna Crosta** (female, ORCID ID: 0000-0001-9164-6672, 4 indexed scientific publications; h-index: 2), currently a second-year PhD student at Roberto Ambrosini's lab.

The expertise for microbial analyses and for sequencing will be provided by **Prof. Andrea Franzetti** (male, ORCID: 0000-0003-1279-9940, 134 indexed scientific publications, h-index = 37, see also the curriculum), currently an associate professor of Microbiology at the Department of Earth and Environmental Science (DISAT), who has a long experience in fieldwork on glaciers, in the microbial ecology of extreme environments, and by **Francesca Pittino** (female, ORCID: 0000-0002-9725-3893, 17 indexed scientific publications, h-index = 8), currently an assistant professor at the University of Milano-Bicocca with a project on the role of bacteria in pollutant degradations. Francesca Pittino also has a sound experience in fieldwork in glacier environments that she acquired during scientific expeditions in the Alps, Andes and in the Arctic.

Microinvertebrates (tardigrades, rotifers, nematodes) in different supraglacial habitats will be identified by **Dr Krzysztof Zawierucha** (male, ORCID: 0000-0002-0754-1411, 79 indexed scientific publications, h-index = 23), currently an associate professor at the Department of Animal Taxonomy and Ecology at Adam Mickiewicz University in Poznań (Poland). Expert in tardigrade taxonomy and ecology, currently working on the diversity, ecophysiological adaptations and biogeography of microscopic metazoans on glaciers.

Radiative transfer simulations will be conducted by Dr Biagio Di Mauro (male, ORCID 0000-0002-8161-3962, 37 indexed scientific publications, h-index = 15) currently a researcher at the Institute of Polar Sciences, National Research Council of Italy who provided a letter of support to this project.

Gamma spectroscopy for radionuclide analyses will be conducted by Dr Monica Sisti (female, ORCID 0000-0003-2517-1909, 196 indexed scientific publications, h-index = 37), currently a senior researcher at Istituto Nazionale di Fisica Nucleare, Milano Bicocca division, and adjunct professor of Radioactivity at the Physics Department of Milano-Bicocca University, who provided a letter of support to this project. She has sound experience in low background measurements and trace element analyses with several techniques and has leading roles in rare event experiments for the control of the radioactive background. These data will be interpreted and compared with similar ones already available from other glaciers thanks to the collaboration with Dr Giovanni Baccolo (male, ORCID 0000-0002-1246-8968, 51 indexed scientific publications, h-index = 16) currently a post-doc researcher at the Paul Scherrer Institute of Villigen (Switzerland) who also provided a letter of support.

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ANNEX 2

Bank Detail Form *(Fill in one form for each participant)*

Recipient:
Bank: Name: ……..Adress
BIC/SWIFT CODE:
Account Number (IBAN)

Reference . of payment: Project ……_Prof.